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The use of Theory of Mind in Pronoun Resolution: An Eye-tracking Study

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Background

- ▶ Language comprehension often requires reasoning about mental states of others (i.e. Theory of Mind: ToM)
- ▶ This experiment examines the use of ToM in pronoun resolution.
- ▶ Is ToM used immediately to constrain a pronoun's antecedent?
- ▶ Or, is there an early stage where ToM information is ignored?

Related work: Counterfactuals

- ▶ Ferguson & Sanford (JML, 2008) examined plausibility effects in real-world or counterfactual contexts:
 - ▶ **Counterfactual:**
If cats were vegetarians, ... families could feed their cats a bowl of carrots/fish ...
 - ▶ **Real world:**
If cats are hungry, ... families could feed their cats a bowl of carrots/fish ...
- ▶ Initial processing difficulty for real-world violation, regardless of context
- ▶ Suggests that counterfactual information ignored in early processing.
- ▶ However, cf. Nieuwland (2012): ERP study showed similar plausibility effects for both real and counterfactual worlds

Experimental Information

- ▶ 40 itemsparticipants
- ▶ Eye-tracking during reading (Eyelink 1000)
- ▶ Stimuli
 - ▶ 40 Short narratives with false belief manipulation
 - ▶ Gender-match manipulation on pronoun to probe pronoun assignment

True Belief condition

Carol and Patrick submitted their scripts to the production team.
The production team decided to produce Patrick's screenplay. After the production team had made the decision, we informed him that he had been chosen to work with the producer and Carol had not. He was interested to hear that the producer had chosen him over the other promising screenwriters instead.
her

False Belief condition

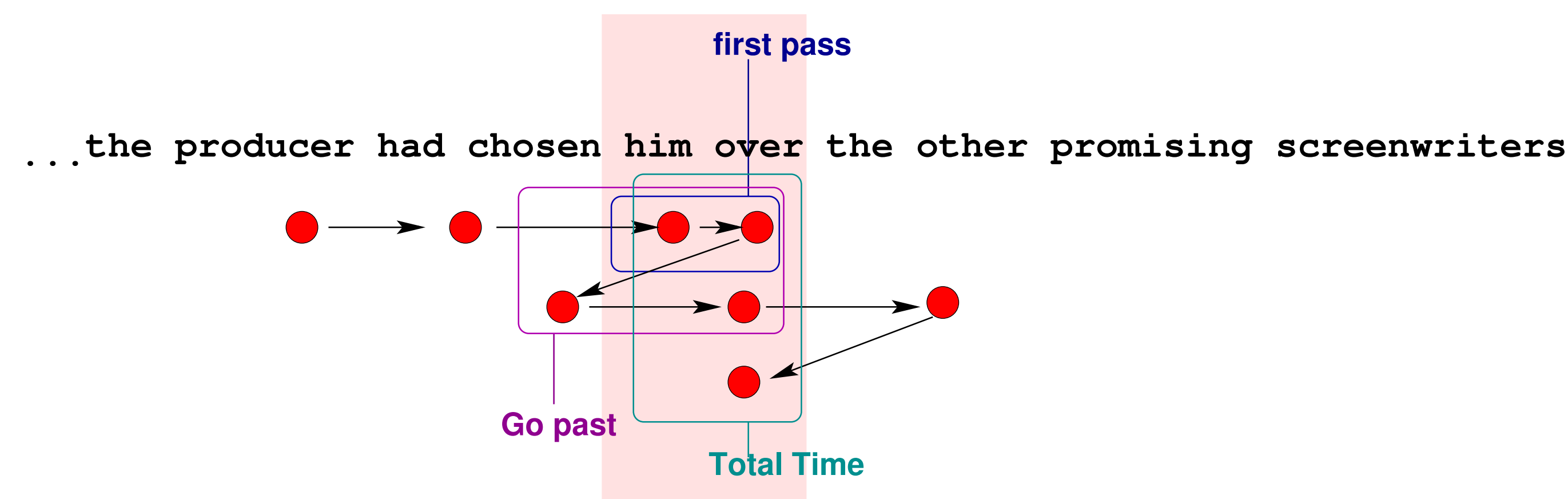
Carol and Patrick submitted their scripts to the production team.
The production team decided to produce Patrick's screenplay. After the production team had made the decision, we playfully misled him to believe that he had not been chosen, and the producer had decided to work with Carol. He was interested to hear that the producer had chosen him over the other promising screenwriters instead.
her

Regions

...the producer had chosen him over the other promising screenwriters

PRE-CRITICAL	PRONOUN	SPILL-OVER
...the producer had chosen	him over	the other promising screenwriters

Measures



- ▶ First-pass/Go-past collectively referred to as "First-pass measures" (they measure fixations immediately after first gaze on relevant information)
- ▶ Total Time is a more general measure of processing (measures fixations regardless of when they occur)

Predictions

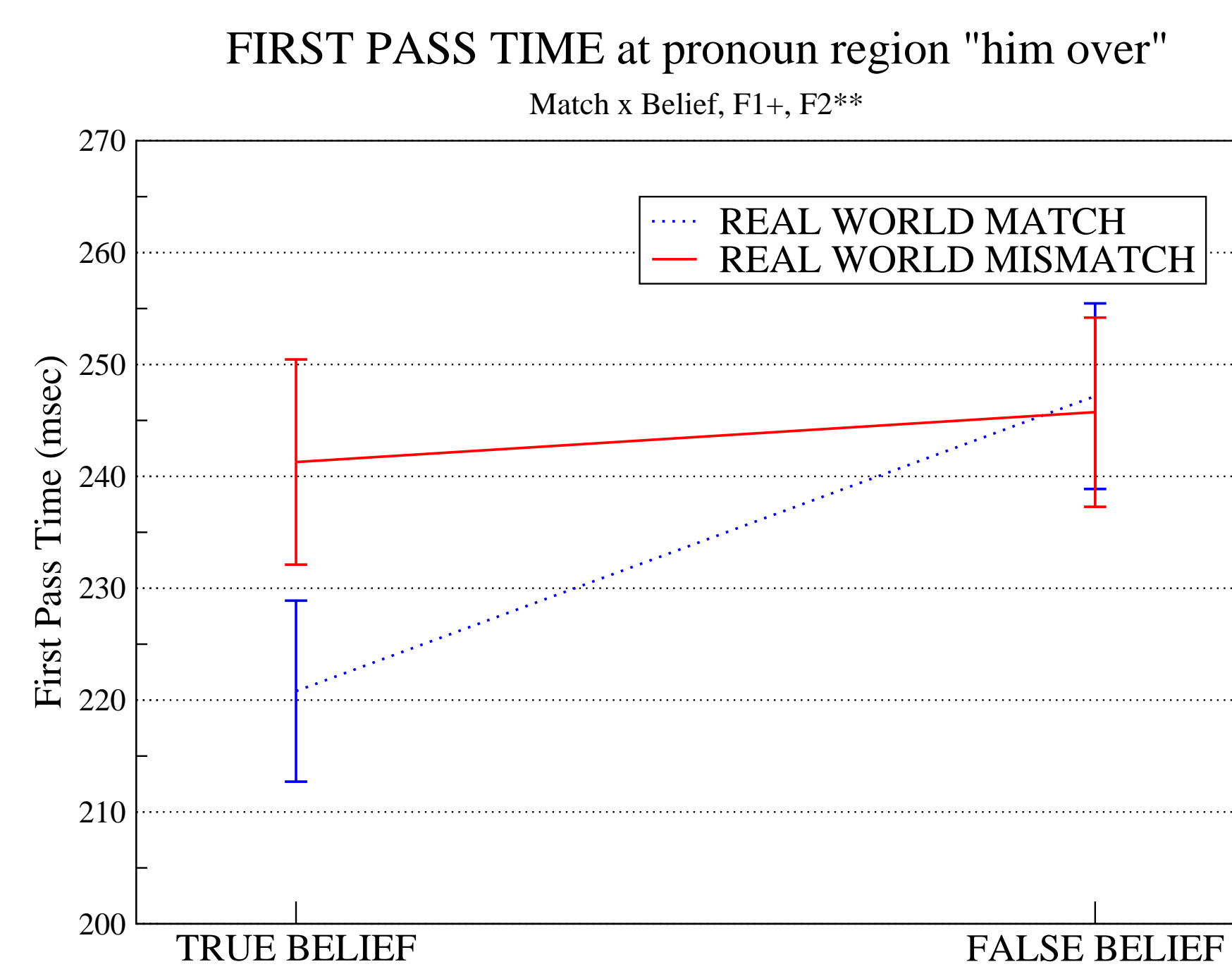
ToM delay Hypothesis (early stage where ToM is ignored)

- ▶ Main effect of gender match in early eye-movement measures
- ▶ No interaction of gender match \times belief in early measures

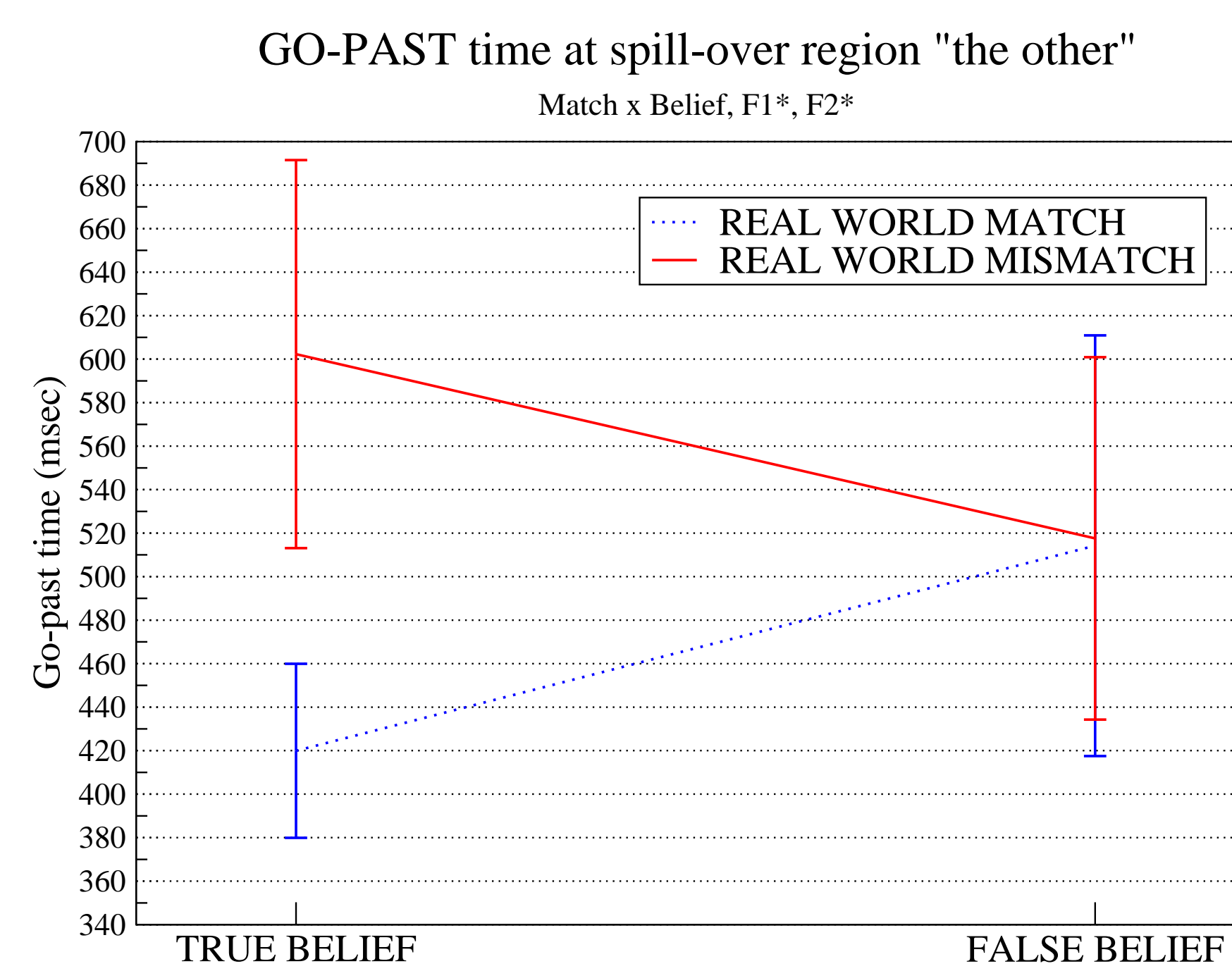
Early ToM Hypothesis (ToM not ignored in early stages)

- ▶ Interaction of gender match \times belief in early measures

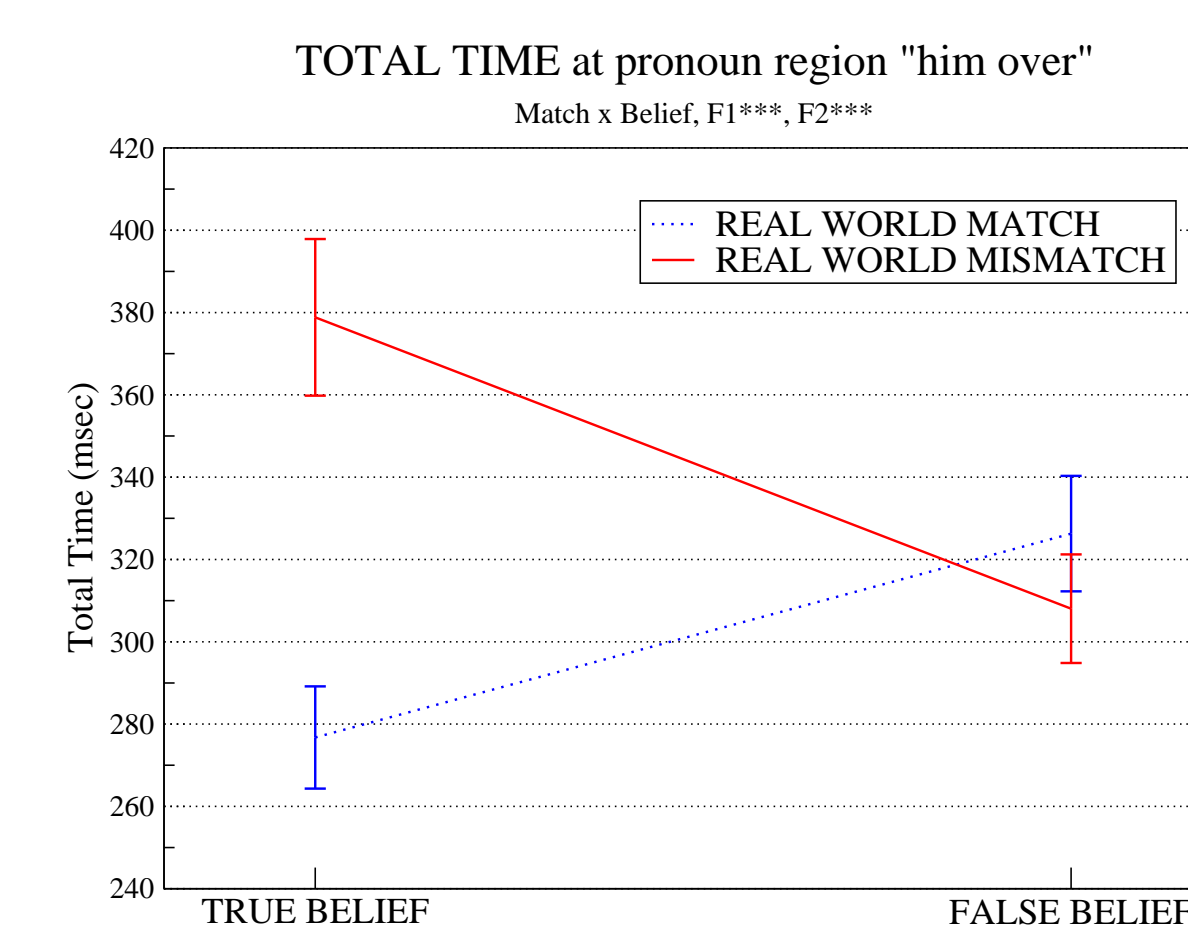
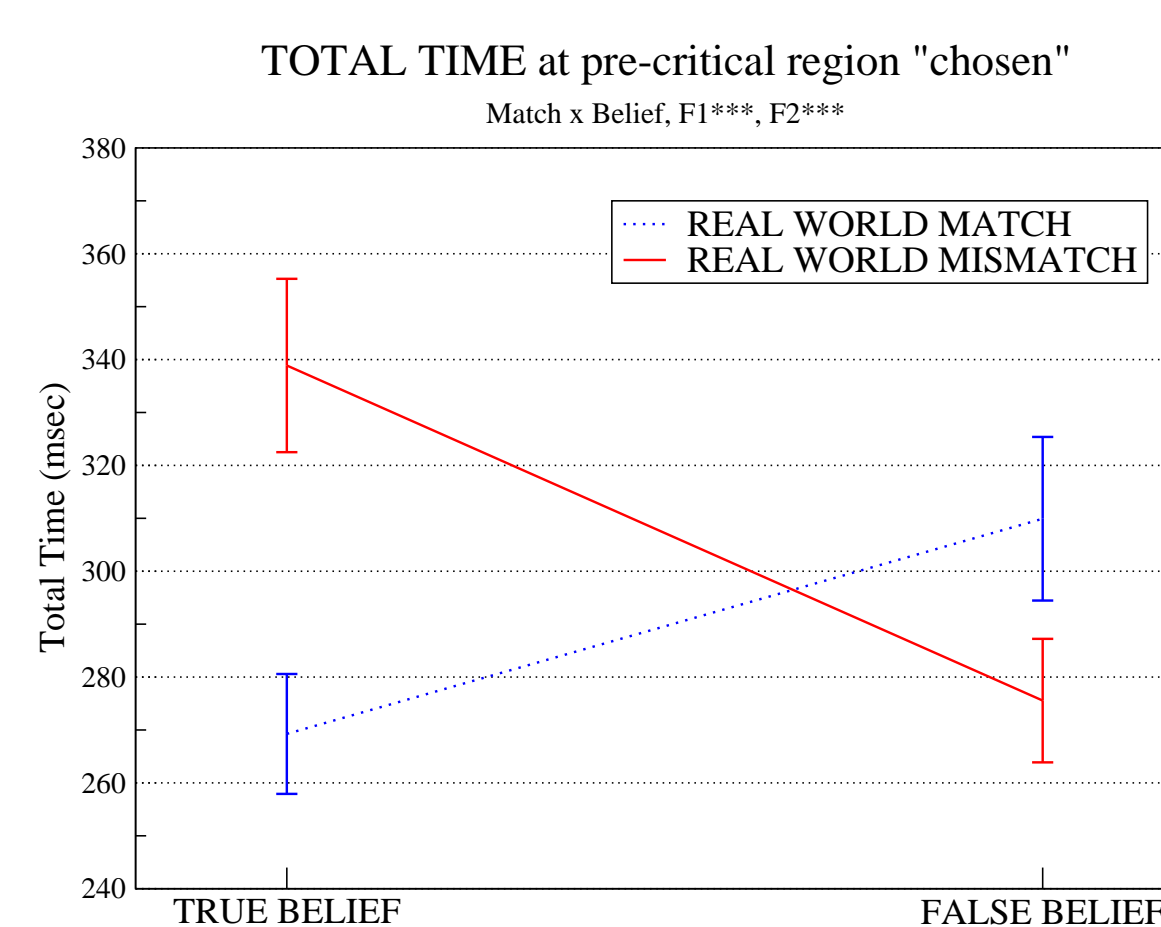
Results: Initial Processing



Results: Spill-over



Results: General Processing Measures



Summary

- ▶ No sign of an early stage where ToM information is ignored:
 - ▶ At the earliest points where gender affected processing, it interacted with belief
 - ▶ gender \times belief interaction found in first-pass measures
- ▶ Main effect of gender-matching was not found in absence of interaction
- ▶ However, gender-matching effect for true-belief condition was larger than for false-belief condition
 - ▶ Suggests either less certainty in false-belief condition, or ToM information may be ignored in some trials.